ERGIS Technical Review Committee Meeting: November 12, 2013, Washington, D.C.

The purpose of this meeting was to review the final datasets created for the 2025 simulations, discuss initial modeling results, high performance computing (HPC) resources, and review transmission assumptions and methods for the study.

Review of Datasets

Solar and Wind datasets

NREL presented final details on several datasets created for the 2025 scenarios. The TRC was presented with a description of the solar and wind datasets created for the study. A variety of questions were asked about validation of the solar dataset. While the eastern solar dataset has not been validated by actual solar data due to lack of measured solar power data, the underlying algorithm has been validated for use in the western United States. NREL has made initial contacts with EPRI to obtain access to actual solar data from resources tracked as part of other DOE funded projects. While the data will be useful for validating the data, NREL has not been provided any funding to conduct analysis on this data and compare it to the algorithm. Futhermore, even if NREL were funded to conduct analysis on the data the analysis could not be completed on the timeline required for use in the ERGIS project. Outside of the ERGIS project NREL will pursue future projects to use the actual solar data to validate the eastern solar dataset.

Questions were also posed on the validation of wind datasets created in 2010. TRC members are encouraged to review sections 4.2 and 7 of AWS Truepower's final report on the Eastern Wind dataset for more information on dataset validation:
http://www.nrel.gov/electricity/transmission/pdfs/aws_truewind_final_report.pdf

NREL proposed a method for creating 5-minute wind data from the 10-minute wind dataset. This method used Fast Fourier Transforms to develop the necessary wind data. This method has been applied successfully in other integration studies.

The TRC approved the use of the wind and solar datasets for use in the study scenarios.

VG Data Analysis

NREL also presented statistical analyses conducted on the wind and solar datasets. These analyses included an annual, seasonal, and diurnal review of the datasets. The TRC generally approved of the analyses and agreed the datasets were acceptable for use in 2025 simulations. Several questions were posed regarding SPP's provision of wind energy to SERC. The significant amounts of wind resources created in SPP for load in SERC created significant ramps for SPP. The TRC agreed that additional review will be necessary to determine how balancing requirements for the SERC resources in SPP will be met. NREL will address these concerns in the coming months and at forthcoming Mitigation Options working group meetings.

Solar Forecasts

NREL has developed a three-part approach to developing day-ahead and 4-hour-ahead solar forecasts for ERGIS. The team explained three methods to develop these forecasts using persistence, data from NOAA's Global Forecasting System (GFS), and NCAR's Weather Research Forecasting (WRF) model. Forecasts for each of the solar sites will be developed and compared to determine their relative performance. NREL's current expectation is that the WRF model will provide the most realistic forecasts for the day-ahead time period and the persistence forecast will be best for intra-day forecasts. The forecasts will be finalized by January 2014 with a formal report in March.

Load Analysis

NREL explained the approach used to develop 5-minute load data based on high-resolution load data information available publicly and from ERGIS TRC members. The TRC was presented information about the data sources, and preliminary net load analyses. There was extensive discussion of the SPP/SERC net load characteristics due to the fact that SPP is assumed to export a large amount of wind power to SERC.

Thermal Expansion

At the June 2013 TRC meeting the TRC requested that NREL redo the thermal capacity expansion. The NREL ERGIS team obtained information from TRC members and other sources. In parallel, the NREL ReEDS team updated the input retirement data to reflect announced retirements due to recent court rulings on EPA regulations. The revised thermal expansion nearly doubled the retirements from the previous analysis. The ERGIS team presented the results of the ReEDS runs using the updated retirement assumptions, and the TRC agreed that the capacity expansion was acceptable.

TRC members asked about sharp changes in generation for each region in the years 2010-2013. NREL explained that these changes were the result of fuel switching caused by historically low natural gas prices. The TRC approved the thermal expansion developed with ReEDS.

NREL Action Items:

- *Implement wind and solar datasets into PLEXOS.*
- *Review options for managing SERC/SPP wind variability and uncertainty.*
- *Proceed with forecasting plans.*
- *Implement sub-hourly load data into PLEXOS.*
- *Implement thermal expansion data into PLEXOS.*

Benchmarking

The NREL ERGIS team presented several activities that had been completed in order to validate the Plexos model's performance at replicating the Eastern Interconnection as it actually operated in 2010.

NREL reviewed the model's assumptions about load and fuel prices in each region, increased the number of transmission zones, and gathered reference information about each region for comparison.

The NREL team presented the results of four sets of benchmarking runs. The first runs isolated each major region of the Eastern Interconnection and were designed to ensure that the major regions had the appropriate amount of generation capacity by type. Generally these runs indicated that the installed capacity was appropriate for coal and nuclear generators and illustrated how much the region imported or exported from its neighboring regions.

The remaining sets of runs allowed interchange between the different regions with different transmission assumptions. The second run used a DC OPF transportation model with 33 nodes (one for each sub-region in the EI) without hurdle rates between regions. This run gave reasonable results for most regions in terms of generation by each fuel type and reflected approximately accurate net imports for FRCC, ISO-NE, MISO, NYISO, and SPP, but gave poor results in terms of net imports for SERC and PJM. Additionally, the direction of net interchange flows between some regions was unrealistic, particularly with NYISO and IESO exporting to Hydro Quebec.

The third and fourth runs used a transportation model for transmission between sub-regions. The third run used no hurdle rates between regions, and the fourth run used $10/MWh hurdle rates between regions. The net interchanges generally increased to unrealistic levels in the run without hurdle rates, but hurdle rates reduced the level of flows to more realistic levels in about half of the regions.

The NREL ERGIS team proposed that the transmission representation was not yet adequate for the study and proposed performing an equivalencing method to reduce the number of lines and nodes in the EI model. The TRC suggested that this approach would introduce more risk of missing future deadlines and might also introduce error into the model results. The TRC requested that the ERGIS team pursue DC OPF of the full interconnection with only certain interface limits enforced rather than network equivalencing. The TRC also suggested that NREL compare the region-to-region transport limits to the historical actual flows to ensure that realistic flow limits are reflected in the model (due to voltage stablility and not solely thermal line limits).

The TRC agreed that the following metrics should be used for evaluating the 2010 model:

- Generation by type in each region
- Net interchange flows between regions (total energy over the year)
- Interchange flow limits between regions (maximums in each direction)
- Operational behavior (such as capacity factor) for selected "typical" generators

NREL Action Items:

- NREL will investigate the transmission representation and the possibility of running the EI with a DC OPF transmission model while only enforcing selected interface limits.
- NREL will gather historical region-to-region flow data to compare to the modeled flows.

Runtime Reduction Efforts

The NREL ERGIS team presented the how much the model runtime could be reduced by several different modifications to the model. The NREL ERGIS team explored generator aggregation, generator commitment, simplified heat rate curves, neglecting minimum up and down times, transmission model (DC OPF vs. transport), decreased time resolution (2-hour versus 1-hour), eliminating the look-ahead, and running the model in parallel in a time-domain decomposition. The TRC reacted favorably to the simplified heat rate curves and the decreased time resolution until they learned that NREL's efforts in time-domain parallelization have been successful and NREL expects to reduce runtimes to a few hours by running the model on NREL's HPC. After learning of the possibility of running on the HPC the TRC suggested that the simplified heat rate curves and decreased time resolution would decrease the model accuracy and should not be implemented as long as the HPC parallelization effort was successful.

NREL Action Items:

- NREL will continue efforts to parallelize the model on NREL's HPC cluster.
- Until the HPC functionality is complete NREL will run with decreased time resolution and simplified heat rate curves.

3-Month Plan

NREL will host at least one Transmission Working Group call to discuss the EIPC transmission build, transmission representation, and additional lines to include in the study.

The next TRC meeting will take place in February in either Denver, CO or Washington DC.

NREL will further develop HPC computing capabilities.

Meeting Participants

Jared Alholinna	GR Energy
Gary Jordan	NREL Contractor
Jack King	NREL Contractor
Stan Hadley	ORNL
Charlie Smith	UVIG
Aaron Townsend	NREL

Venkat Banunarayanan	DOE
Caitlin Callaghan	DOE
Charlton Clark	DOE
Doug Middleton	DOE
Tony Ingram	EEI
Michael Goggin	AWEA
Kevin Thundiyil	Exelon
Clayton Barrows	NREL
Jason Schmidt	Ventyx
Jay Caspary	SPP
Mitchel Williams	Western Farmers
Matt Schuerger	Energy Systems Consulting Services
Mark Ahlstrom	WindLogics
Emily Fisher	LBL
Jon Black	ISO-NE
Jordan Bakke	MISO
Barbara O'Neill	NREL
Rick Roberts	EPRI
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Pam Silberstein	NRECA
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